TRANSIT MARKET ANALYSIS OF FREeway-ORIENTED EXPRESS BUSES

Highway 1 High Occupancy Vehicle Lane Widening Project
From San Andreas-Larkin Valley Roads to Morrissey Boulevard
05-SCR-1, PM R733 (KP 11.79) 7.6 to PM 16.13 (KP 25.96)
EA: 05-0C730K
Santa Cruz County, California

May 2008
EXECUTIVE SUMMARY

Introduction - This transit market analysis was conducted in conjunction with the Highway 1 High Occupancy Vehicle Lane Widening Project to understand the market conditions for freeway-oriented express buses in the corridor. The Highway 1 High Occupancy Vehicle Lane Widening Project, proposes to improve commute times, encourage transit, carpooling and alternative modes. Three alternatives are under consideration –

- No-Build Alternative - The No-Build Alternative assumes no major construction on Highway 1 through the project limits other than planned and programmed improvements and continued routine maintenance.
- The Transportation System Management Alternative proposes ramp metering on existing interchange ramps with auxiliary lanes constructed between interchanges.
- The High Occupancy Vehicle Lane Alternative would widen the existing highway configuration of four through lanes to a six-through-lane facility by adding a high occupancy vehicle lane in both the northbound and southbound directions.

The limits of the Highway 1 High Occupancy Vehicle Lane Widening Project extends from south of the San Andreas–Larkin Valley Road Interchange to north of the Morrissey Boulevard Interchange. For the purposes of this study, this report includes all corridor data available, for 14.2 kilometers (8.8 miles) between San Andreas Road/Larkin Valley Road and the Branciforte Drive Overcrossing, just south of the Highway 1/Highway 17 interchange, called “traffic study corridor” or “Highway 1 study corridor”.

The Highway 1 study corridor in Santa Cruz is a highly traveled, heavily congested traffic corridor with up to 115,000 vehicles per day in 2005. The corridor also has high transit ridership. While comparable suburban areas would have transit ridership of about two percent of the total highway trips, the transit ridership in this corridor is about twice that, showing high existing transit demand.

Objectives - The transit market study has three primary objectives:

- To identify and quantify the potential market for freeway-oriented transit services in the Highway 1 corridor.
- To determine how much of the expected transit market would likely be captured by each of the three Highway 1 High Occupancy Vehicle Lane Widening Project Alternatives.
- To determine what transit enhancements would 1) facilitate transit operations in the new high occupancy vehicle lanes and 2) in conjunction with ramp metering and auxiliary lanes constitute a viable lower-cost alternative to High Occupancy Vehicle Lane Widening.

Methodology - The transit market analysis focuses on quantifying the additional market for transit services and on the potential for Santa Cruz County Metropolitan Transit District (Metro) to capture these additional transit riders under each alternative. The transit market analysis was conducted in three steps as described below:
Estimation of current and future 2035 express bus ridership based on express bus ridership from Metro and current and future transit ridership from Association of Monterey Bay Area Governments (AMBAG)

Determination of ridership sensitivity to travel time and fare changes

Estimation of latent demand, the demand that could be captured above and beyond the existing ridership.

Express services considered for the study - The transit market study looked at the Santa Cruz-based express bus market that would use Highway 1 within the project limits. The express routes analyzed were 69 A, 69 W and 91 W. The peak-hour trips of the Highway 17 express bus service which originate or end at the Soquel Park-and-Ride Lot were also included in the analysis.

Results - Highway 1 through Santa Cruz is an unusual transit corridor that has high transit ridership without the dense city center usually necessary to achieve comparable levels of ridership. The high transit ridership is probably due to a high proportion of low-income service workers, but may also be due to UCSC student ridership.

Much of the express bus ridership originates at Watsonville. There is a large low-income “captive-rider” market in Watsonville commuting into Santa Cruz. “Captive” riders are transit users who use transit because they do not have access to an automobile for variety of reasons.

Average daily express bus ridership in the corridor varied from 2,300 riders per day in 2003 to about 2,000 riders per day in 2006, excluding Highway 17 ridership. Projected 2035 transit ridership, without Highway 17 ridership, would be between 2,300 riders per day with current service frequency and travel times and 2,800 riders per day if transit service frequency were increased to that of 2003 (prior to the 2003 and 2004 service cuts) while maintaining current travel times. This represents a growth of about 18 to 21 percent, respectively. With Highway 17 ridership included, the future express bus ridership would vary between 3,400 and 3,700 riders per day.

The analysis of the transit ridership over the period prior to the bus drivers’ strike in October 2005 showed that express bus ridership in the Highway 1 corridor is highly sensitive to travel time changes. It is also sensitive to fare changes, but to a lesser degree.

Latent express bus demand in the corridor was estimated based on the results of an express bus demand study that compared the socio-economic characteristics and express bus demand of eight metro areas across the US. Comparing the characteristics of the study region to these eight regions, the latent demand for express transit in the corridor was estimated to be about an additional 40 percent of the projected future transit ridership (without Highway 17 service). The latent demand for Highway 17 service was not included in this analysis, since that express demand is driven by a San Jose based employment market.

The following subsections describe the estimated future ridership and amount of latent demand captured under each project alternative.

No-Build Alternative - By 2035, without highway capacity improvements, the express buses would be subjected to very congested travel conditions on the freeway. Therefore, under the No-Build Alternative the projected growth would not be realized. None of the latent demand would be captured, and ridership may decrease compared with existing conditions. Metro would also experience increased operating and capital costs to maintain its current level of service due to slower bus travel times requiring more drivers and buses.
Transportation System Management Alternative - Travel time through the corridor under the Transportation System Management Alternative would be better than under No-Build Alternative, except in the southbound direction during evening peak hour. Discussions between Metro and the design team confirmed that there is no practical way to use auxiliary lanes to enhance Highway 1 freeway-oriented transit bus operations. Express bus service would consequently encounter similar conditions as the rest of the general traffic.

Transit enhancements such as expanded park-and-ride lots, more peak period express service, and connecting shuttle buses or expanded express routing to serve local destinations, would be generally supportive of transit, but do not offer any real time savings. Even under an enhanced Transportation System Management Alternative, therefore, the projected growth would likely not be realized, and the ability of Metro to capture any of the latent demand would be substantially degraded.

HOV Alternative - With the addition of high occupancy vehicle lanes, buses and other high occupancy vehicles would receive a high level of service and would travel at free-flow speeds of about 63 to 64 mph through the project limits in the peak commute direction (northbound in the morning and southbound in the evening), while the automobiles in the mixed-flow lanes would experience some congestion relief but would still be traveling at 30 to 36 mph, well below free-flow speeds. This compares to speeds as low as 11 mph under the No Project Alternative.

Under the High Occupancy Vehicle Lanes Alternative, the projected future transit ridership and more can be realized. Since the transit market is very sensitive to changes in travel time, the introduction of high occupancy vehicle lanes to improve transit travel times would be extremely important to capture additional riders (latent demand), especially choice riders. Half of the latent ridership could be captured by improvements in travel time due to the addition of high occupancy vehicle lanes. If the six runs that were cut back from the three express routes in the past few years were added back or comparable express service were added in the corridor, the rest of the latent demand could be captured.
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1 INTRODUCTION

This transit market analysis was conducted in conjunction with the Highway 1 High Occupancy Vehicle Lane Widening Project to understand the market conditions for freeway-oriented express buses in the corridor. The Highway 1 High Occupancy Vehicle Lane Widening Project, described in Chapter 2, proposes to improve commute times, encourage transit, carpooling and alternative modes. For this purpose, the project is evaluating different capacity and operational improvement options such as adding high occupancy vehicle lanes, auxiliary lanes, ramp metering, park and rides, bus stops, etc.

The limits of the Highway 1 High Occupancy Vehicle Lane Widening Project extends from south of the San Andreas–Larkin Valley Road Interchange to north of the Morrissey Boulevard Interchange. For the purposes of this study, this report includes all corridor data available, for 14.2 kilometers (8.8 miles) between San Andreas Road/Larkin Valley Road and the Branciforte Drive Overcrossing, just south of the Highway 1/Highway 17 interchange, hereafter called “traffic study corridor” or “Highway 1 study corridor”.

1.1 OBJECTIVES

The transit market study has three primary objectives:

- To identify and quantify the potential market for freeway-oriented transit services in the Highway 1 corridor; this will respond to the Santa Cruz County Regional Transportation Commission’s Highway 1 HOV Project goal to encourage alternate modes of transportation.

- To determine how much of the expected transit market would likely be captured by each of the three Highway 1 High Occupancy Vehicle Lane Widening Project Alternatives – No-Build Project Alternative, Transportation System Management (TSM) Alternative and High Occupancy Vehicle Lane Alternative.

- To determine what transit enhancements would 1) facilitate transit operations in the new high occupancy vehicle lanes and 2) in conjunction with ramp metering and auxiliary lanes constitute a viable lower-cost alternative to high occupancy vehicle lane widening. This element was performed in conjunction with Santa Cruz County Metropolitan Transit District (Metro) and design team to identify transit options or enhancements that would reach more transit users.

The scope of the study is defined by the following tasks. Tasks that depend on the travel demand model were defined before transit limitations of the model were discovered in this study, as will be discussed under Section 3, Methodology. These limitations required bypassing the travel demand model for most of the study analysis, with the affected tasks being approached qualitatively. The remainder of this technical report describes the project alternatives, existing conditions, study methodology, and results.

Task 1: Assess the appropriate scope of transit options or enhancements to be investigated

This task has the following steps:

- Define existing and planned transit services in the corridor, based on existing conditions reports and ridership data from Metro.
- Coordinate with other team members to avoid duplication of effort and ensure consistency of
assumptions and parameters, and to determine forecast levels of transit ridership.

- Look at potential size of the transit market based on literature survey. This approach was previously applied successfully to size the transit market for travel using Highway 101/Cuesta Grade into San Luis Obispo.
- Determine how much of the expected transit market might be captured by existing alternatives.
- Produce a memorandum to define the potential transit ridership market.

**Task 2: Refine options or enhancements as appropriate to reach more transit users.**

A range of low- to higher-cost transit options or enhancements will be examined. The primary focus will be twofold: to determine what transit enhancements in conjunction with ramp metering and auxiliary lanes constitute a viable lower-cost alternative to high occupancy vehicle lane widening; and to facilitate transit operations in the new high occupancy vehicle lanes; either approach may include park-and-ride support as necessary. Planning level costs will be estimated. Consideration will be given to potential ridership and construction feasibility. A maximum of three new transit enhancements or options is expected, to be described in a memorandum on potential transit options and enhancements.

**Task 3: Test transit enhancements in the travel model**

This is a test of the efficacy of any new transit enhancements or options in the travel forecasting model. It would probably require one or more runs of the travel model, depending on the extent of any new enhancements or facilities conceived.

**Task 4: Evaluate and modify transit enhancements as necessary based on travel model results**

Using the revised estimates for transit market capture, the proposed enhancements will be evaluated and modified based on cost effectiveness.

**Task 5: Summarize and document results for presentation to study team**

The approach and results will be summarized in a technical memorandum as well as included in the environmental document.
2 PROJECT DESCRIPTION

The Highway 1 High Occupancy Vehicle Lane Widening Project proposes to widen Highway 1 (designated State Route 1) for a distance of approximately 14.5 kilometers (9.0 miles), from approximately 0.6 kilometers (0.4 miles) south of the San Andreas-Larkin Valley Road Interchange to 0.4 kilometers (0.3 miles) north of the Morrissey Boulevard Interchange to reduce congestion, encourage carpooling and use of alternative transportation modes as a means to increase transportation system capacity, and improve safety. Meeting these project purposes would also address the following related needs:

- Improve operations,
- Reduce delay for commuters, commerce, and emergency vehicles;
- Provide incentives to increase transit use and ridesharing;
- Reduce congestion-related accidents; and
- Reduce cut-through traffic on local streets.

Three alternatives are currently under consideration, a No-Build Alternative, a Transportation System Management (TSM) Alternative, and a High Occupancy Vehicle Lane Alternative as described below.

![Figure 1: Project Location](image-url)
2.1 No-Build Alternative

The No-Build Alternative offers a basis for comparison with the TSM and High Occupancy Vehicle Lane Alternatives in the future analysis year of 2035. It assumes no major construction on Highway 1 through the project limits other than planned and programmed improvements and continued routine maintenance. Planned and programmed improvements included in the No-Build Alternative incorporate the following improvements contained in the 2005 Regional Transportation Plan (RTP):

- Construction of merge lanes at the Highway 1/Highway 17 Interchange.
- Installation of median barrier on Highway 1 from Freedom Boulevard to Rio Del Mar Boulevard.
- Construction of auxiliary lanes between the Soquel Avenue–Soquel Drive and Morrissey Boulevard interchanges and reconstruction of the Morrissey Boulevard interchange.

Also included in the No-Build Alternative are a number of locally sponsored projects for improving the local arterial network and constructing and improving bicycle lanes.

2.2 Transportation System Management (TSM) Alternative

The Transportation Systems Management Alternative proposes ramp metering on all interchange on-ramps within the project limits with auxiliary lanes constructed between the following interchanges:

- Freedom Boulevard and Rio Del Mar Boulevard.
- Rio Del Mar Boulevard and State Park Drive
- State Park Drive and Park Avenue.
- Park Avenue and Bay Avenue–Porter Street.
- Bay Ave–Porter Street to 41st Street (southbound only)
- 41st Avenue and Soquel Avenue–Soquel Drive

Auxiliary lanes are designed to reduce conflicts between traffic entering and exiting the highway by connecting the on-ramp of one interchange to the off-ramp of the next; auxiliary lanes are not designed to serve through traffic. The Transportation System Management Alternative also would include transit enhancements such as park and ride lots and Transportation Operations System (TOS), electronic equipment such as changeable message signs and vehicle detection systems.

The north and south Aptos railroad underpasses and the State Park Drive, Capitola Avenue, and 41st Avenue overcrossings would be reconstructed. The Aptos Creek and Soquel Creek bridges would be widened. Pedestrian/bicycle overcrossings would be constructed across Highway 1 at Trevethan Avenue, Chanticleer Avenue, and Mar Vista Drive. This alternative would not include high occupancy vehicle lanes or any additional through lanes on the mainline.

2.3 High Occupancy Vehicle Lane Alternative

The High Occupancy Vehicle Lane Alternative would widen the existing four-lane highway to a six-lane facility by adding an high occupancy vehicle lane in both the northbound and southbound directions. Along the southern portion of the project, the median generally is wide enough to incorporate the new high occupancy vehicle lanes within the existing right-of-way. Along the northern reach of the project, where the median is narrower, widening would occur. In some locations this widening would extend outside the existing right-of-way.
The High Occupancy Vehicle Lane Alternative would modify or reconstruct all nine interchanges within project limits to improve merging operations and ramp geometrics, lengthen acceleration and deceleration lanes, and improve sight distances. Bridge structures, including the two existing railroad underpass structures and the Capitola Avenue Overcrossing, would be modified or replaced to accommodate highway widening. Roadway crossing structures would include shoulder and/or sidewalk facilities to accommodate pedestrians and bicycles. The High Occupancy Vehicle Lane Alternative would include pedestrian/bicycle overcrossings of the highway at Trevethan Avenue, Chanticleer Avenue, and Mar Vista Drive, as described under the Transportation System Management Alternative. It also would include ramp metering and auxiliary lanes between interchange ramps and TOS electronic equipment, as described under the Transportation System Management Alternative with the exception that an auxiliary lane would not be constructed northbound between State Park Drive and Park Avenue. Transit improvements would include new or expanded park and ride lots. Bus pads with pedestrian access to local streets would be constructed at some highway ramps to facilitate faster and easier highway access for buses. Bus pads are bus stops on freeway ramps for freeway-oriented express buses.

Retaining walls would be constructed at the most effective and visually appropriate locations to minimize right-of-way acquisition, reduce or avoid environmental impacts, and separate frontage roads from the highway. The project also would include demolition and disposal, excavation, borrow and fill, sound walls, right-of-way acquisition, and temporary easements.
3 EXISTING ROADWAY AND EXPRESS BUS ROUTE CONDITIONS

The Highway 1 study corridor is a highly traveled, heavily congested traffic corridor with up to 115,000 vehicles per day in 2005. The corridor also has high transit ridership. While comparable suburban areas would have transit ridership of about two percent of the total highway trips, the transit ridership in this corridor is about twice that, showing high existing transit demand.

Congested traffic conditions exist northbound in the morning and southbound in the evening, the ‘peak commute directions’. Currently (2003) the corridor has average peak-hour travel speeds around 26 to 30 mph in the peak commute directions. (Extended three-hour peak period travel speeds are also as low as 26 to 30 mph.) By 2035, without any improvements to the highway 1 corridor, traffic congestion in the corridor is forecasted to double. Under such congested traffic conditions, express buses would travel at speeds as low as 11 mph along with other traffic. There would be no incentive for travelers to use transit or for Metro to field enhanced Highway 1 freeway-oriented transit services. Adding an high occupancy vehicle lane in each direction, on the other hand, would provide new dedicated peak-hour capacity to buses and carpools/vanpools. With high occupancy vehicle lanes in place, buses and carpools would travel at free-flow speeds of 63 to 64 mph through the project limits during peak commuter directions. The high occupancy vehicle lanes would also improve conditions for mixed-flow traffic; the automobiles in the mixed-flow lanes would be traveling at 30 to 36 mph, compared to speeds as low as 11 mph without the high occupancy vehicle lanes.

3.1 Existing and Forecasted Future Roadway Conditions

Highway 1 serves local traffic between the cities and communities in Santa Cruz County; commute traffic within the county and to Santa Clara and Monterey Counties; and tourist and recreational-oriented traffic. In addition, Highway 1 is the primary route for goods movement to and from most communities in Santa Cruz County.

The Highway 1 study corridor extends from south of the Highway 1/17 interchange ramps to San Andreas/Larkin Valley Road (8.8 miles). In the corridor, Highway 1 has two through travel lanes each direction, for a total of four lanes, and contains nine interchanges.

Table 1 shows the current and forecasted future traffic condition in the Highway 1 study corridor. Currently the corridor has average peak-hour (northbound in the morning and southbound in the evening) travel speeds around 26 to 30 miles per hour (mph) with travel times from 23 to 27 minutes through the 8.8 mile study corridor. Based on project forecasts, peak hour and extended three-hour peak-period congestion and travel time on Highway 1 in the study corridor will more than double by 2035. Buses and carpools will travel at speeds as low as 11 mph along with other traffic. Evening peak hour conditions are generally more congested than the morning peak hour, and vehicles operate in stop-and-go and queued conditions. In both the northbound and southbound directions, the highest daily traffic volumes occur between the Morrissey Boulevard and Soquel Drive interchanges and between the 41st Avenue and Bay/Porter Street interchanges.
Table 1: Comparison of Traffic Conditions in the Study Corridor – Existing Condition and Year 2035 No-Build Alternative

<table>
<thead>
<tr>
<th></th>
<th>Existing</th>
<th></th>
<th>2035 No Build</th>
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<tbody>
<tr>
<td></td>
<td>AM (peak)*</td>
<td>PM</td>
<td>AM (peak)*</td>
<td>PM</td>
</tr>
<tr>
<td>Northbound</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Travel Time (minutes)</td>
<td>23</td>
<td>15</td>
<td>59</td>
<td>34</td>
</tr>
<tr>
<td>Average Speed (mph)</td>
<td>30</td>
<td>39</td>
<td>12</td>
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<td>Delay (minutes per vehicle)</td>
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<td>48</td>
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</tr>
<tr>
<td>Level of Service</td>
<td>F</td>
<td>E</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>Southbound</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Travel Time (minutes)</td>
<td>10</td>
<td>27</td>
<td>29</td>
<td>61</td>
</tr>
<tr>
<td>Average Speed (mph)</td>
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<td>22</td>
<td>11</td>
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<tr>
<td>Delay (minutes per vehicle)</td>
<td>0</td>
<td>15</td>
<td>19</td>
<td>49</td>
</tr>
<tr>
<td>Level of Service</td>
<td>C</td>
<td>F</td>
<td>F</td>
<td>F</td>
</tr>
</tbody>
</table>

*Peak commute directions are northbound in the morning and southbound in the evening. Peak Hour – Highest one hour within the peak period (Peak Period – 6 AM to 12 AM and 2 PM to 8 PM)

Source: Traffic Operations Report, Highway 1 High Occupancy vehicle Lane Widening Project, July 2007

3.2 Existing Transit Conditions

Metro provides bus transit services in Santa Cruz County. Though Metro provides several local and express bus transit services in the region, this study focuses only on the express buses using the Highway 1 study corridor. Routes 69 A, 69 W, Route 91 and Highway 17 express service are the express bus routes which serve the Highway 1 study corridor. Figure 2 and

Figure 3 presents these routes serving the Highway 1 corridor and the appendix shows the route schedules. These routes are briefly described below.

Transit services to and from Monterey County are provided at the Watsonville Transit Center via connections with Monterey-Salinas Transit. Amtrak and Greyhound bus lines provide service to the San Francisco Bay Area, with Caltrain and Amtrak train connections in San Jose to Sacramento, Oakland and San Francisco.

All the bus stations are accessible by pedestrians and travelers on bikes. The major bus stations are equipped with bike parking facilities. The buses are equipped with bike racks.

3.2.1 Highway 17 Express Bus Service to Santa Clara County

Highway 17 express bus service serves a San Jose-based transit market. This express bus line started as an emergency transportation service while Highway 17 was closed to regular traffic after the 1989 Loma Prieta Earthquake. The bus service became very successful and was later expanded. This joint project of the Santa Cruz Metropolitan Transit District (SCMTD), AMTRAK, and the Santa Clara Valley Transportation Authority (VTA) has been a success since its inception.
This service originates at the Metro Center located at 920 Pacific Avenue in downtown Santa Cruz. The express service has seven northbound weekday trips originating at the Soquel Park and Ride Station and five southbound weekday trips terminating at this station during morning and evening peak hours. These northbound trips terminate near San Jose State University in San Jose. This line utilizes Highway 1 beginning at Soquel Drive, continuing on Highway 1 to Highway 17 and serves the Cavallaro Transit Center (earlier called Scotts Valley Transit Center) located in southwestern Scotts Valley. This express bus line travels 1.4 miles on Highway 1 within the Highway 1 study corridor during morning and evening peak hours. During off-peak hours the Highway 17 Express originates at the Metro Center and accesses Highway 17 directly, without utilizing Highway 1.

3.2.2 Express Bus Route 91 – Watsonville to Santa Cruz Commuter Express

This limited stop bus line, provided by Metro, originates at the Watsonville Center located at 475 Rodriguez St, near downtown Watsonville and terminates at the Metro Center in downtown Santa Cruz. This line serves Cabrillo College, west side employment centers, downtown Watsonville, Capitola Mall, Dominican Hospital, the Soquel Drive Park-and-Ride lot, and the County Government Center. Northbound Route 91 utilizes Highway 1 from the City of Santa Cruz to the City of Watsonville, roughly about 4.8 miles in the morning and 6.2 miles in the evening on Highway 1 within the Highway 1 study corridor (see Figure 3). Southbound Route 91 utilizes Highway 1 for about 6.2 miles from the City of Santa Cruz to the City of Watsonville. Route 91 serves both southbound and northbound Highway 1. Route 91 runs northbound on Highway 1 approximately every 25 minutes beginning at 6:00 AM through 7:30 AM with additional morning runs at 8:30 AM and 9:30 AM (seven runs total); these runs stop at the Soquel Drive Park-and-Ride lot. Afternoon runs on northbound Highway 1 occur at 3:30, 4:30 and 5:30, and do not serve the Park-and-Ride lot. Runs heading southbound on Highway 1 depart hourly from about 6:30 until 9:30 AM, with afternoon runs at 3:30 and 4:30. Route 91 southbound does not serve the Soquel Drive Park-and-Ride lot.

3.2.3 Route 69A –Capitola Road/Santa Cruz/ Watsonville (serves Watsonville Hospital)

This local Metro bus route originates at the Watsonville Center and terminates at the Metro Center. Route 69A travels on Highway 1 in both directions from 41st Avenue (within the study area) to Airport Boulevard. Route 69 A utilizes 5.9 miles of Highway 1 within the Highway 1 study corridor. Both weekday and weekend services are provided. On weekdays, Route 69A runs hourly from 6:20 AM through 6:20 PM, while on weekends, this route runs hourly between 8:07 AM and 6:07 PM. This route does not serve any of the park-and-ride lots along the study corridor.

3.2.3 Route 69W –Capitola Road/Santa Cruz/ Watsonville (serves Cabrillo College)

This local Metro bus route also originates at the Watsonville Center and terminates at the Metro Center. Route 69A travels on Highway 1 in both directions from State Park Drive (within the study area) to Green Valley Boulevard. Route 69 A utilizes 2.8 miles of Highway 1 within the Highway 1 study corridor. Both weekday and weekend services are provided. On weekdays, Route 69W runs hourly from 6:37 AM through 6:30 PM, while on weekends, this route runs hourly between 8:37 AM and 8:37 PM. This route does not serve any of the park-and-ride lots along the study corridor.

3.3 Existing Express Bus Ridership (2003 to 2007)

The transit market study looked at the Santa Cruz-based express bus market that would use Highway 1 within the project limits. The express routes analyzed were 69 A, 69 W, 91 W and selected Highway 17 bus trips which use the Highway 1 study corridor. The schedules of these buses and their individual route maps are shown in the appendix. The first three express buses run between Watsonville and Santa Cruz.
Much of the express bus ridership originates at Watsonville. There is a large low-income “captive-rider” market in Watsonville commuting into Santa Cruz. “Captive” riders are transit users who use transit because they do not have access to an automobile for variety of reasons. “Choice” riders are transit users who could drive if they wished to.

The Highway 17 express bus caters to a San-Jose based transit market. Only the peak hour trips of the Highway 17 express bus service, 12 of the 51 trips, originate or end at the Soquel Park-and-Ride Lot and use a short stretch of Highway 1 within the project limits. Only this fraction of the ridership which uses Highway 1 within the project limits is included in the analysis.

Table 1 shows the average daily express bus ridership from 2003 to 2007. Within this time period, Metro had two service cuts, in 2003 and 2004, and a fare increase in 2004. These changes had an effect on ridership as can be seen in Table 1. Average daily express bus ridership in the corridor, without Highway 17 service, varied from 2,300 riders per day in 2003 to about 2,000 riders per day in 2007. With Highway 17 ridership which uses the study corridor, average daily express bus ridership in the corridor, varied from 2,900 riders per day in 2003 to about 2,750 riders per day in 2007.

<table>
<thead>
<tr>
<th>69 A</th>
<th>69 W</th>
<th>91 W</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watsonville Center</td>
<td>Watsonville Mall</td>
<td>Watsonville Center</td>
</tr>
<tr>
<td>Airport Blvd</td>
<td>Pennsylvania</td>
<td>Main St</td>
</tr>
<tr>
<td>4th Ave</td>
<td>Ocean View</td>
<td>1st Ave</td>
</tr>
<tr>
<td>7th Ave</td>
<td>Freedom Blvd</td>
<td>6th Ave</td>
</tr>
<tr>
<td>1st Ave</td>
<td>Watsonville Hospital</td>
<td>9th Ave</td>
</tr>
<tr>
<td>Metro Center</td>
<td>Capitola Mall</td>
<td>Metro Center</td>
</tr>
</tbody>
</table>

Figure 2: Express Transit Routes Considered for This Study (See Appendix for Highway 17 Express Service)
Table 2: Average Daily Express Bus Ridership in the Corridor

<table>
<thead>
<tr>
<th>YEAR</th>
<th>69 A NB*</th>
<th>69 A SB**</th>
<th>69 W NB</th>
<th>69 W SB</th>
<th>91 W NB</th>
<th>91 W SB</th>
<th>17 NB</th>
<th>17 SB</th>
<th>TOTAL Without 17</th>
<th>TOTAL With 17</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>409</td>
<td>404</td>
<td>534</td>
<td>579</td>
<td>235</td>
<td>159</td>
<td>293</td>
<td>320</td>
<td>2,320</td>
<td>2,933</td>
</tr>
<tr>
<td>2004</td>
<td>355</td>
<td>351</td>
<td>501</td>
<td>546</td>
<td>218</td>
<td>98</td>
<td>313</td>
<td>332</td>
<td>2,068</td>
<td>2,713</td>
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<td>2005</td>
<td>425</td>
<td>397</td>
<td>495</td>
<td>533</td>
<td>202</td>
<td>92</td>
<td>334</td>
<td>337</td>
<td>2,142</td>
<td>2,813</td>
</tr>
<tr>
<td>2006</td>
<td>433</td>
<td>371</td>
<td>466</td>
<td>493</td>
<td>151</td>
<td>87</td>
<td>383</td>
<td>357</td>
<td>2,000</td>
<td>2,740</td>
</tr>
<tr>
<td>2007</td>
<td>440</td>
<td>363</td>
<td>453</td>
<td>449</td>
<td>167</td>
<td>78</td>
<td>406</td>
<td>392</td>
<td>1,949</td>
<td>2,748</td>
</tr>
</tbody>
</table>

* NB – Northbound
** SB - Southbound
Figure 3: Transit Routes and Park and Ride Facilities in Highway 1 Corridor
4 METHODOLOGY

Express buses are the most prominent transit service using the Highway 1 in the study corridor. There is no rail, trolley, subway, or other forms of transit available or planned for the. Hence this study focuses on freeway oriented transit opportunities and it does not explore other forms of transit on freeways. Passenger train service is being considered for the future. But due to prohibitive cost of construction and uncertainties regarding implementation of this service, the possibility of train service was not factored into this study. Similar to the freeways, the main arterials in Santa Cruz are also very congested during peak hours, hence altering the existing express-bus routes to use local roads so as to avoid the freeway congestion was also not pursued in this study.

Hence, the transit market analysis focuses on quantifying the additional market for freeway-oriented express bus services using Highway 1 in the study corridor and on the potential for Metro to capture additional transit riders under each project alternative. The transit market analysis was conducted in three steps as described below:

- Estimation of current (2003 to 2007) and future (2035) trip tables
- Determination of Ridership Sensitivity to Travel Time and Fare Changes and
- Estimation of Latent Demand

These steps are explained in detail below.

4.1 Analyzing Current (2003 to 2007) and Future (2035) Trip Tables

The first step in the transit market analysis was to analyze existing ridership in order to identify the demand for Highway 1 freeway-oriented transit. Express bus routes which use the study corridor were analyzed. The express services reviewed include Routes 69A, 69W, 91 and Highway 17 express service. These existing transit services were reviewed to determine whether the current level of transit service is adequate to meet the current and future transit travel demand.

Transit trip tables from the Association of Monterey Bay Area Governments (AMBAG) regional model were analyzed to review the transit ridership in the corridor and assess transit growth rates to the horizon year. AMBAG’s projected future transit numbers are based on population and employment growth and a low level of transit enhancements such as expanded park-and-ride lots. The AMBAG trip tables for existing conditions are based on the census data. When compared to the existing express route ridership numbers from Santa Cruz Metropolitan Transit District (Metro), the transit ridership estimated from the AMBAG trip tables were found to be substantially low for trips between Watsonville and Santa Cruz and high for trips within Watsonville. While the AMBAG trip tables were useful for determining growth rates, they did not capture the large low-income population using transit to commute to Santa Cruz jobs.

Much of the express bus demand in the corridor originates from Watsonville. Watsonville has a large low-income population working in Santa Cruz and nearby areas and living in Watsonville because of cheaper housing. These people are poorly represented in the census data and hence the transit volumes from AMBAG trip tables were found to be much lower than the actual transit volumes. Hence, the transit market analysis was revised with the current express route ridership numbers from Metro.

The future transit demand was calculated from existing ridership numbers from Metro and future transit growth rates from the AMBAG trip tables. Express service ridership for four years from 2003 to 2007 was analyzed to determine the current ridership and demand. Detailed bus ridership data is not available prior to 2003 because Metro first began using fare boxes to record ridership in July 2002. Growth rates...
from the AMBAG model based on adopted population and employment forecasts were used to extrapolate the current express bus ridership to the 2035 forecast year.

### 4.2 Elasticity - Variation of Ridership with Travel Time and Fare Changes

To determine the factors that affect ridership in the Santa Cruz corridor, Metro ridership data over the past few years were analyzed to determine response to fare and level of service changes. Metro had three consecutive service cuts; from 2002 to 2004. Service cuts increased the most sensitive component of total travel time for a transit rider, the wait time for the next express bus. There was also a 50 percent increase in fare in 2004. Elasticity analysis was conducted to determine how ridership changes with travel time changes and fare changes.

Elasticity is the ratio of the proportional change in one variable with respect to proportional change in another variable. Economists use several terms to classify the relative magnitude of elasticity values. Unit elasticity refers to elasticity with an absolute value of 1.0, meaning that price or travel time changes cause a proportional change in consumption. Elasticity values less than 1.0 in absolute value are called inelastic, meaning that price or travel time changes cause less than proportional changes in consumption. Elasticity values greater than 1.0 in absolute value are called elastic, meaning that price or travel time changes cause more than proportional changes in consumption. When the elasticity values are negative, as they are in this analysis, it means that increases in fare or travel time cause decreases in the level of ridership.

#### 4.2.1 Variation of Ridership with Travel Time Changes

Total travel time from origin to destination includes the following main components:

- **Ingress Time** – Access time from trip origin to boarding express bus stop.
- **Wait Time** – Waiting time for next express bus
- **Line-Haul Time** – Travel time on the express bus
- **Egress Time** – Access time from final alighting stop to destination.

Access time, both ingress and egress, depends on access mode. Waiting time is a function of headways (time between two successive buses on the same route). Line-haul time includes total travel time once inside the express bus, including time when the bus pauses at different bus stops along the route.

Wait time, the most sensitive component of total travel time, is influenced by the service headway. **Service headway is the time between two consecutive bus arrivals. For example if a bus line serves a station at 30 minute intervals, then the service headway is 30 minutes.** When service headway exceeds about 15 minutes, as is the case with all the express bus routes under consideration, transit patrons tend to consult timetables and arrive at the express bus stop shortly before the bus is scheduled to arrive. While average wait time would be half of the headway if transit users did not consult schedules, it is assumed to be close to one-third of the service headway in this analysis to reflect the tendency to consult schedules with longer headways in the corridor.

Elasticity of transit ridership with respect to travel time shows the effect of travel time changes on ridership. A high elasticity value, regardless of whether it is positive or negative, indicates that the ridership is sensitive to travel time. For example, if the elasticity of transit ridership with respect to travel time is -2.0; this means that a 10 percent transit increase in travel time increase will cause ridership to decline by about 20 percent.
Elasticity equations can be derived in different ways depending on the different variables involved. A “shrinkage ratio” elasticity equation showing the elasticity of ridership with respect to travel time is shown below.

\[
\text{Elasticity} = \frac{(Rn - Ro)}{(Rn + Ro)} \cdot \left(\frac{Tn - To}{Tn + To}\right)
\]

Where:
- \(Rn\) = New ridership
- \(Ro\) = Old Ridership
- \(Tn\) = New travel time
- \(To\) = Old travel time

### 4.2.2 Variation of Ridership with Fare Changes

Similar to changes in travel time, changes in fare also influence transit ridership. Metro introduced a 50 percent increase in fare in 2004. Fare elasticities were computed to estimate the change in ridership due to changes in fare.

### 4.3 Estimation of Latent Demand

Latent transit demand is defined as the absolute maximum transit demand that exists in the corridor. This includes the additional ridership that could be captured above and beyond the existing ridership. To project the additional transit ridership that could be captured, latent transit demand was estimated from US DOT research on express bus and park-and-ride demand in other areas such as Richmond (Virginia), Louisville (Kentucky), Hartford (Connecticut), etc. Conditions in the Highway 1 corridor were compared with the research conditions to determine the transit potential of the local area relative to other areas.\(^1\)

This study defines express bus as bus service which follows route length of at least 5 to 10 miles, connects limited residential neighborhood circulation and/or parking lots with a high activity employment, transportation or recreational center and makes very few stops (for eg., it does not stop every quarter of a mile) during the line-haul segment of the trip. Express bus systems are primarily applicable to medium to large urban areas with substantial volumes of central business district (CBD)-oriented commuter trips longer than eight miles.

Comparing express bus demand data for eight cities with a strong CBD, the study suggests ranges for total express demand in a city/suburban area based on its demographics. This total demand represents the upper limit of the express bus demand in the corridor.

The study states that in many areas, a large portion of the express bus demand have based their mode choice not on the availability of an alternate mode but also on the dependability, convenience and comfort of the bus service. The expectations of these “choice riders” must be upheld to capture the latent demand.

### 4.4 Collaboration with Metro

During each step of the analysis Metro was consulted. Discussions with Metro were carried out to understand how Metro served the current demand and their plans for the future. Possibilities for improving or adding new Highway 1 freeway-oriented bus services to capture the additional demand were discussed with Metro. As part of this step, we coordinated with Metro and the engineering team to incorporate facilities on the ground such as bus stops/pull-outs and park-and-ride facilities.

In conjunction with Metro and design team, this study also identifies transit options or enhancements as appropriate to reach more transit users. A review of possible options was conducted with Metro and the engineering team to determine what transit enhancements in conjunction with ramp metering and auxiliary lanes would constitute a viable lower-cost alternative to high occupancy vehicle lane widening, and to facilitate transit operations in the new high occupancy vehicle lanes.

4.5 Summary

Based on the current ridership analysis and elasticity analysis, the future transit ridership was estimated. The service Metro plans to provide for the future was compared to the findings of this analysis to determine whether there is latent demand, either current or projected, that could be addressed with upgraded transit services. The percentage of latent demand in the corridor that can be captured under each alternative was then estimated. The possibilities for improving or adding new Highway 1 freeway-oriented bus services to capture the additional demand were investigated.
5 RESULTS

5.1 Overview

Highway 1 through Santa Cruz is an unusual transit corridor that has high transit ridership without the dense city center usually necessary to achieve comparable levels of ridership. The high transit ridership is probably due to a high proportion of low-income service workers, but may also be due to UCSC student ridership.

Much of the express bus ridership originates at Watsonville. There is a large low-income “captive-rider” market in Watsonville commuting into Santa Cruz. “Captive” riders are transit users who use transit because they do not have access to an automobile for variety of reasons. “Choice” riders are transit users who could drive if they wished to.

5.1.1 Ridership

As discussed in Section 4.3, Existing Express Bus Ridership, express ridership in the corridor in 2003 was approximately 2,900 riders per day, including those riding the Highway 17 express buses which start or end at the Soquel Park and Ride Lot. There was a drop in ridership in the following years due to service cuts and fare increase. Current ridership in 2007 is approximately 2,750 riders/day.

Future growth rates were determined from analyzing the AMBAG transit trip tables. Future ridership would also depend on the service frequency provided and travel time in the corridor. Since frequency of bus service have been changing notably between 2003 and 2007, future ridership would vary depending on which base year is considered. Or in other words as shown in Table 2, future ridership would 3,678 if the same level of service is provided as in 2003. If the level of service provided is similar to that in 2005, the ridership would drop to 3,498.

Projected 2035 express bus ridership, without Highway 17 express bus ridership, would be between 2,300 riders per day with current service frequency and travel times and 2,800 riders per day if transit service frequency were increased to that of 2003 (prior to the 2003 and 2004 service cuts) while maintaining current travel times. This represents a growth of about 18 to 21 percent, respectively.

Highway 17 express bus ridership increased from 860 riders/day in 2003 to about 1,080 riders/day in 2007. Including Highway 17 ridership, the 2035 express bus ridership would vary between 3,400 and 3,700 riders per day as shown in Table 3.

<table>
<thead>
<tr>
<th>BASE YEAR</th>
<th>69 A NB</th>
<th>69 A SB</th>
<th>69 W NB</th>
<th>69 W SB</th>
<th>91 W NB</th>
<th>91 W SB</th>
<th>17 NB</th>
<th>17S B</th>
<th>TOTAL Without 17</th>
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<tr>
<td>2003</td>
<td>496</td>
<td>490</td>
<td>648</td>
<td>703</td>
<td>285</td>
<td>193</td>
<td>413</td>
<td>450</td>
<td>2,816</td>
<td>3,678</td>
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<tr>
<td>2004</td>
<td>428</td>
<td>424</td>
<td>604</td>
<td>659</td>
<td>264</td>
<td>118</td>
<td>437</td>
<td>463</td>
<td>2,496</td>
<td>3,396</td>
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<td>2005</td>
<td>510</td>
<td>476</td>
<td>594</td>
<td>640</td>
<td>242</td>
<td>110</td>
<td>461</td>
<td>466</td>
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<td>2006</td>
<td>517</td>
<td>443</td>
<td>556</td>
<td>588</td>
<td>180</td>
<td>87</td>
<td>524</td>
<td>489</td>
<td>2,370</td>
<td>3,383</td>
</tr>
<tr>
<td>2007</td>
<td>522</td>
<td>431</td>
<td>537</td>
<td>533</td>
<td>198</td>
<td>77</td>
<td>551</td>
<td>532</td>
<td>2,298</td>
<td>3,381</td>
</tr>
</tbody>
</table>

5.1.2 Elasticity

Elasticity analysis was conducted to determine the variation of ridership with travel time. The analysis generated elasticity coefficients less than -2.0. The high absolute values of elasticity showed that the express bus ridership in this corridor is extremely elastic with respect to travel time changes. Express bus ridership in this corridor was found to be elastic to fare changes as well, but to a much lesser degree.

5.1.3 Latent Demand

As explained in Section 3.2, Estimation of Latent Demand, latent express bus demand in the corridor was estimated based on the results of an express bus demand study that compared the demographic characteristics and express bus demand of eight metro areas across the US. Comparing the characteristics of the study region to these eight regions, the latent demand for express transit in the corridor was estimated to be about an additional 40 percent of the projected future transit ridership (without Highway 17 service). The latent demand for Highway 17 service was not included in this analysis, since that express bus demand is driven by a San Jose based employment market.

How much of this latent demand could be captured would depend on the services provided by Metro and the actual in-vehicle travel time for express buses. The in-vehicle transit time depends on future travel conditions on the freeway under the particular project alternatives. The following subsections describe the estimated future ridership and amount of latent demand captured under each project alternative.

5.1 No-Build Project Alternative

The No-Build Alternative assumes no major construction on Highway 1 through the project limits other than planned and programmed improvements and continued routine maintenance. By 2035 without capacity or operational enhancements on Highway 1 capacity, congestion and travel time on Highway 1 will worsen considerably. Buses and carpools will be subjected to very congested travel conditions, traveling at speeds as low as 11 mph, along with single-occupancy automobiles. Travel times in the 8.8 mile study corridor would be about one hour from, including 48 to 49 minutes of delay. These slow travel times would defeat efforts to increase transit service. There would be no travel time incentive to carpool or transit, and average vehicle occupancy would likely remain at 1.13 to 1.24, the same as under existing 2005 conditions.

Currently, congested conditions on Highway 1 cause delays to the Highway 17 express service that uses Highway 1. Metro is considering the options of extending the Highway 17 service farther south to State Park, if travel conditions for express buses on Highway 1 improve, or removing the service from the Highway 1 corridor if travel conditions continue to degrade.

This estimated future 2035 express bus ridership quantifies the ridership that would be achieved if current traffic/transit conditions were maintained. In reality, by 2035, without highway capacity improvements, the express buses would be subjected to very congested travel conditions on the freeway. Therefore, under the No-Build Alternative the projected growth would not be realized. None of the latent demand would be captured, and ridership may decrease compared with existing conditions. Metro would also experience increased operating and capital costs to maintain its current level of service due to slower bus travel times requiring more drivers and buses.
### Table 4: Comparison of Traffic Conditions in the Study Corridor – Year 2035 No-Build Alternative, Transportation System Management Alternative, and High Occupancy Vehicle Lane Alternative

<table>
<thead>
<tr>
<th></th>
<th>2035 No Build</th>
<th>2035 TSM</th>
<th>2035 HOV (Mixed-Flow Lane)</th>
<th>2035 HOV (HOV Lane)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Northbound</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AM (peak)*</td>
<td>59</td>
<td>34</td>
<td>34</td>
<td>19</td>
</tr>
<tr>
<td>PM</td>
<td>34</td>
<td>29</td>
<td>19</td>
<td>15</td>
</tr>
<tr>
<td>Average Speed (mph)</td>
<td>12</td>
<td>17</td>
<td>21</td>
<td>36</td>
</tr>
<tr>
<td>Delay (minutes per vehicle)</td>
<td>48</td>
<td>25</td>
<td>22</td>
<td>8</td>
</tr>
<tr>
<td>Level of Service</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>E</td>
</tr>
<tr>
<td><strong>Southbound</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AM (peak)*</td>
<td>29</td>
<td>61</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>PM</td>
<td>61</td>
<td>62</td>
<td>24</td>
<td>30</td>
</tr>
<tr>
<td>Average Speed (mph)</td>
<td>22</td>
<td>11</td>
<td>54</td>
<td>51</td>
</tr>
<tr>
<td>Delay (minutes per vehicle)</td>
<td>19</td>
<td>49</td>
<td>2</td>
<td>2</td>
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<tr>
<td>Level of Service</td>
<td>F</td>
<td>F</td>
<td>D</td>
<td>F</td>
</tr>
</tbody>
</table>

* peak travel directions are northbound in the morning and southbound in the evening.

**Peak Hour** – Highest one hour within the peak period (Peak Period – 6 AM to 12 AM and 2 PM to 8 PM)

**Source:** Traffic Operations Report, Highway 1 High Occupancy vehicle Lane Widening Project, July 2007

### 5.2 Transportation System Management Alternative

The Transportation System Management Alternative proposes ramp metering on existing interchange ramps with auxiliary lanes constructed between interchanges. The Transportation System Management Alternative also would include transit enhancements such as park-and-ride lots and Transportation Operations System (TOS) electronic equipment such as changeable message signs and vehicle detection systems. These transit enhancements would provide a slightly better scenario for increased carpooling or transit use when compared to No-Build conditions. Like the No-Build, without capacity improvements, the express buses would be subjected to very congested travel conditions on the freeway and there would be no real travel time incentive to carpool or use transit. Vehicle occupancy is estimated to improve to about 1.19 - 1.26. This alternative would not include high occupancy vehicle lanes or any additional through lanes on the mainline.

Travel time through the corridor under the Transportation System Management Alternative would be better than under No-Build Alternative, except in the southbound direction during evening peak hour. Continued peak hour congestion in the southbound direction with the Transportation System Management Alternative is due to the convergence of projected demand “upstream” of Morrissey Boulevard with traffic entering the corridor from the Ocean Avenue on-ramp, southbound traffic on Highway 1 from the Highway 9/River Street intersection, and traffic merging onto Highway 1 from Highway 17. In contrast, peak-period congestion will be reduced because the addition of auxiliary lanes enable traffic entering and exiting the freeway to make these weaving movements out of the main flow of through traffic, which results in some minor congestion improvement.

The round trip travel times would be much worse than existing travel times, however, causing an increase in Metro operating and capital costs to maintain existing levels of transit service in the evening peak.
period. Several operational schemes (including running the express buses on auxiliary lanes and providing signal pre-emption to express buses at intersections) were considered to improve express bus service in the corridor under the Transportation System Management Alternative. Discussions between Metro and the design team confirmed that there is no practical way to use auxiliary lanes to enhance Highway 1 freeway-oriented transit bus operations. Express bus service would consequently encounter similar conditions as the rest of the general traffic.

Transit enhancements such as expanded park-and-ride lots, more peak-period express service, and connecting shuttle buses or expanded express routing to serve local destinations, would be generally supportive of transit, but do not offer any real time savings. Even under an enhanced Transportation System Management Alternative, therefore, the projected growth would likely not be realized, and the ability of Metro to capture any of the latent demand would be substantially degraded.

5.3 High Occupancy Vehicle Lane Alternative

The High Occupancy Vehicle Lane Alternative would widen the existing highway configuration of four through lanes to a six-through-lane facility by adding an high occupancy vehicle lane in both the northbound and southbound directions. This High Occupancy Vehicle Lane Alternative would modify or reconstruct nine interchanges. It also would include ramp metering and auxiliary lanes between interchange ramps and TOS electronic equipment. Transit improvements would include park-and-ride lots and bus stops. Bus stops with pedestrian access to local streets would be constructed at three highway ramps to facilitate faster and easier highway access for buses. Vehicle occupancy is estimated to improve to about 1.22 - 1.28.

As shown in Table 4, with the addition of high occupancy vehicle lanes, buses and other high occupancy vehicles would receive a high level of service and would travel at free-flow speeds of about 63 to 64 mph through the project limits in the peak commute directions, while the automobiles in the mixed-flow lanes would experience some congestion relief but would still be traveling at 30 to 36 mph, well below free-flow speeds. This compares to speeds as low as 11 mph to 12 mph under the No Project Alternative. Thus with high occupancy vehicle lanes, in 2035, express buses would be moving at about 28 to 33 mph faster than mixed-flow traffic and about 52 miles per hour faster than no-build conditions.

Under the High Occupancy Vehicle Lanes Alternative, the projected future transit ridership and more can be realized. Since the transit market is very sensitive to changes in travel time, the introduction of high occupancy vehicle lanes to improve transit travel times would be extremely important to capture additional riders (latent demand), especially choice riders. Half of the latent ridership could be captured by improvements in travel time due to the addition of high occupancy vehicle lanes. If the six runs that were cut back from the three express routes in the past few years were added back or comparable express service were added in the corridor, the rest of the latent demand could be captured.

Capture of latent express transit demand would also depend on other factors such as adequate corridor park-and-ride lot capacity.

- The Park-and-Ride Study (Wilbur Smith Associates, 2007) conducted as part of the proposed project estimates future park-and-ride occupancy to be about 344 percent by year 2035, or 205 available spaces trying to serve a future demand of 706 vehicles. In total, there would be 199 additional spaces required for increases in Metro ridership on Routes 17 Express, 69A, 69W, 91, and 71, and 454 spaces required for new carpoolers taking advantage of the future high occupancy vehicle lanes. To meet the projected demand the study recommends adding additional spaces where the future occupancy rates would be highest, such as at the Soquel Drive/Paul Sweet Road and the Resurrection Church lots. When considering new park-and-ride facilities, the study recommends adding facilities in the southern segment of the corridor, such as a park-and-
ride lot near the Larkin valley Road or Freedom Boulevard exit. See the Park and Ride Study Report (Wilbur Smith Associates, 2007) for more details.

- Based on the park and ride study, the project is planning to add new park and ride lots at Freedom Boulevard and at 41st Avenue. Discussions with Metro are underway to decide which of the existing lots should have increased capacity.

- Capture of the latent market for transit also assumes bus stops at strategic corridor locations to improve rider access to the express buses and a pedestrian and bike friendly environment with access to/from park-and-ride lots and bus stop locations. The bus stop locations under consideration are at Park Avenue, Bay/Porter Avenue, and at 41st Street.

Introduction of high occupancy vehicle lanes would also facilitate extension of the Highway 17 express bus service farther south in the corridor to park-and-ride lots on Highway 1 as far south as State Park. This extension would help capture additional choice riders. Daily Highway 17 transit ridership using Highway 1 would increase from approximately 1,080 to 1,500, an increase of about 40 percent.

5.4 Recommendations

1. Adding buses and operational support during highway 1 project construction -

   One main factor that impedes Metro from running more express bus service is the severe congestion on the freeway, which increases in-vehicle time as well as transit operating costs. The lack of operational and maintenance (O&M) funds is also an impediment to running express buses and was the cause of the service cuts. Adding buses and operations support as part of the traffic management plan (TMP) during the construction phase of the Highway 1 High Occupancy Vehicle Lane Widening Project would improve the O&M issue near term. Reducing congestion within the project limits by adding high occupancy vehicle lanes would help make express bus travel times competitive with the automobile in the long term.

2. Consistent coordination with Metro -

   Meetings with the Metro staff to date suggests that Metro is interested in and would be supportive of this approach to enhancing transit services in the Highway 1 corridor.

3. Even though increased transit would not be a complete solution to the congestion related problems in this corridor, addition of high occupancy vehicle lanes would notably improve transit travel conditions in the corridor.

   - Because there is very high auto use in this corridor, the improvements to transit would capture only a small portion of the total auto traffic. Maximizing the transit market above current levels would remove perhaps an additional 50 to 100 vehicles per hour from Highway 1 in the peak hour. However, this captured ridership in addition to the existing transit ridership in the corridor would be high compared to similar suburban areas.

   - Without high occupancy vehicle lanes, buses would be stalled along with other automobiles in highly congested mixed-flow lanes; transit service costs would increase and transit ridership would likely decline. Improvements to transit in the corridor, such as improving in-vehicle travel time by adding High occupancy vehicle lanes, would increase transit ridership and make service costs more manageable by improving level of transit service.

   - Without the High occupancy vehicle lanes, transit performance will degrade and the corridor will face an ever shrinking transit market, particularly from choice riders.

   - Introduction of High occupancy vehicle lanes would facilitate the capture of additional riders. Additional service should be aimed at both the choice rider market and the captive
rider market, first as construction mitigation and then as ongoing service utilizing the HOV lanes.
6. APPENDIX

METRO EXPRESS BUS ROUTES AND SCHEDULES INCLUDED IN THIS STUDY
### Santa Cruz Metropolitan Transit District

#### 69 Capitola Road/Cabrillo/Watsonville

<table>
<thead>
<tr>
<th>Route</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
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</thead>
<tbody>
<tr>
<td>69A</td>
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<td></td>
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**More pm times continued on right**

All Metro bases are wheelchair accessible, while some stops on this route may not be.

NOTE: Car/Train service is available weekdays at Cabrillo College to individuals with disabilities. Call 471-6270. See homepage for details.

### Effective / Vigente 9/7/2006

#### 69 Capitola Road/Cabrillo/Watsonville

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All Metro bases are wheelchair accessible, while some stops on this route may not be.

- **A** Arrives at Cabrillo Upper Campus, Legal Campus Superior de Cabrillo
- **B** Trip ends at Soquel Drive & 4th Avenue 5 min. later, Viajeros down on Soquel Dr. & 4th Ave 5 min. later.
- **C** Fish/Santa Cruz/Cabrillo College and then serves as a limited express between Cabrillo College and Watsonville Transit Center, stopping only at the main stops shown, and these additional stops: Soquel & State Park, Main & Brown Parkway, Main & Pennsylvania, Main & Rodriguez.
- **D** The route serves as a limited express between the Center of Monterey and Cabrillo College and also serves as an express limited between Cabrillo College and the Center of Monterey/Watsonville, periodic: Somodimos en los puntos de tiempo mostrados y estaciones adicionales: Soquel & State Park, Main & Brown Parkway, Main & Pennsylvania, and Main & Rodriguez.

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